OBITUARY

Neil Bartlett (1932–2008)

Founder of noble-gas chemistry.

Neil Bartlett, who died on 5 August at the age of 75 from an aortic aneurysm, was one of the foremost chemists of the twentieth century. His discovery in the early 1960s of xenon fluorides, the first examples of a noble-gas compound, was a sensation. With one stroke of genius, he destroyed the long-standing dogma that the 'noble gases' (also previously known as the inert or rare gases) are unreactive.

Bartlett was born in 1932, in Newcastle upon Tyne, UK, and studied for both his undergraduate and postgraduate degrees at the University of Durham. Following a brief spell as a chemistry teacher, in 1958 he emigrated to Canada and took up a position as a lecturer at the University of British Columbia (UBC) in Vancouver. In 1964, he became a full professor at UBC, but in 1966 moved to a professorship at Princeton University and also joined the research staff at Bell Telephone Laboratories in Murray Hill, New Jersey. In 1969, he accepted a professorship at the University of California, Berkeley, and became a faculty senior scientist at the Lawrence Berkeley National Laboratory, positions he held until his retirements in 1993 and 1999, respectively.

Attempts to prepare compounds of the noble gases date back to the discovery of argon by William Ramsay in 1894. Among the ensuing notable events was Walther Kossel's 1916 prediction, on the basis of ionization potentials, that krypton and xenon fluorides should exist. However, attempts to verify that prediction — by Andreas von Antropoff and then by Otto Ruff and Walter Menzel — were unsuccessful. Ruff was one of the greatest inorganic fluorine chemists of all time, and had the required experience and experimental skills for the task at hand. Unfortunately, he pursued only argon and krypton fluorides, and not those of xenon.

In 1933, Linus Pauling published a paper predicting the existence of H_4XeO_6 , and of KrF_6 and XeF_6 . Using electric discharges of xenon–fluorine mixtures, his colleagues Don Yost and Albert Kaye came close to making xenon fluorides. But they did not succeed in isolating measurable amounts. That failure was taken generally as evidence that the noble gases are indeed unreactive, a principle that found its way into essentially all textbooks.

Bartlett, however, was undeterred. In 1962, at UBC, he carried out his famous experiment demonstrating that noble gases are not chemically inert. While pursuing the synthesis of platinum difluoride, PtF_2 , by

reduction of PtF_4 , he purified PtF_4 by heating it in a stream of diluted fluorine in a Pyrex apparatus. He obtained a red sublimate, which he initially thought was platinum fluoride oxide, PtF_4O , but subsequently identified correctly as the ionic salt dioxygen hexafluoroplatinate, $\text{O}_2^+\text{PtF}_6^-$ — an oxidation reaction had occurred. Although the discovery of this compound was accidental, as Bartlett himself stated in Volume 9 of the *World Scientific Series in 20th Century Chemistry*, his subsequent reasoning and experiments were brilliant. He recognized that if PtF_6 can oxidize dioxygen, it should also be capable of oxidizing xenon.

His classic experiment in preparing xenon hexafluoroplatinate, $\text{Xe}^+\text{PtF}_6^-$, confirmed his reasoning, and gave rise to a worldwide interest in noble-gas chemistry. Since then, thousands of papers have been published on this subject, showing that xenon can form bonds not only to fluorine but also to many other elements of the periodic table. Moreover, noble-gas chemistry is not limited to xenon — even argon can form compounds, such as HArF . Although some of them are unstable, they nevertheless exist.

Bartlett's discovery of the first noble-gas compound was hailed by *Chemical & Engineering News* as "one of the 10 most beautiful experiments in the history of chemistry", and "one of the most important developments in inorganic chemistry in modern times". It was not, however, a one-off stroke of luck. Throughout his career, Bartlett continually demonstrated this same keen sense of reasoning and mastery as an experimentalist. He made many subsequent contributions to the field that he created,

particularly in the area of xenon fluoride cations and molecular adducts of xenon fluorides with other molecules. In all of his publications, the emphasis was on quality and not quantity.

Later on, he worked on problems such as the creation of synthetic metals from graphite and graphite-like boron nitride and salts of perfluoro-aromatic cations. Another major success was his synthesis and characterization of thermodynamically unstable compounds at the limits of oxidation, such as NiF_4 and AgF_3 . These compounds are powerful oxidizers and are ideal sources for the generation of high concentrations of fluorine radicals under very mild conditions.

Bartlett's achievements were recognized with 25 international and national awards, fellowships in 12 different academies and societies, and honorary degrees from 9 universities. But perhaps because of his modesty and lack of interest in lobbying for honours, he did not receive the Nobel Prize in Chemistry — which, in my opinion and those of many of his peers, was clearly deserved. This sentiment is reflected by István Hargittai in the chapter "Who did not win" of his book *The Road to Stockholm*:

Significantly, many chemists today assume that Bartlett has won a Nobel Prize, and in this connection the most spectacular misconception can be found in Primo Levi's book, 'The Periodic Table'. On the first page of the first chapter, he mentions Bartlett's discovery: 'As late as 1962 a diligent chemist after long and ingenious efforts succeeded in forcing the Alien (xenon) to combine fleetingly with extremely avid and lively fluorine, and the feat seemed so extraordinary that he was given a Nobel prize.'

The lack of the ultimate scientific recognition, the Nobel prize, in no way diminishes the impact Bartlett has had on chemistry, both directly and through his influence on students and at scientific meetings. He was an outstanding lecturer, and at meetings invariably impressed participants with his ingenious ability to analyse problems and come up with elegant solutions. But perhaps his most memorable traits were his humbleness, friendliness, loyalty and concern for others: Neil Bartlett was not only a brilliant scholar but also a true gentleman.

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